

45A/1182 Mekoryuk Bulk Fuel Upgrade (BFU) Project  
Denali Commission Final Closeout Summary Report  
March 14, 2012

This Final Closeout Summary Report is filed with the federal grantor agency the Denali Commission (“Denali” or “DC”) by the grantee partner Alaska Village Electric Cooperative, Inc. (“AVEC”). The federal grants affected by this report and/or by this DC Energy Program project are: Denali awards 0049-DC-2002-I2, 0098-DC-2003-I12, 170-05, and 1182; and USDHHS – Administration for Native Americans (ANA) award 90NK0129.

An initial project closeout report entitled “Award Transition and Closeout Summary” was submitted for this project (specifically regarding only project 45A, but not including award 1182) on June 15, 2009. At the time, the project was still in construction under an active Denali award, 170-05. That initial, transitional closeout report was necessary because funds allocated to this project from the earlier Denali awards 0049-DC-2002-I2, 0098-DC-2003-I12, and 170-05 had been fully expended, and the awards had expired and were being closed. This final closeout summary report is being filed because the project is now complete, all funding has been expended, and a subsequent award 1182 has also expired and is being closed. No federal funds are available for de-obligation from any award on this project. Total project costs exceed total project funding by \$37,572; the grantee has paid these additional costs.

This report represents the project status as of December 31, 2011. All fuel storage capacities are stated in terms of gross capacity (“shell” capacity). The terms “BFU” and “tank farm(s)” are synonymous.

**Project Location and Scope:**

Mekoryuk, Alaska is situated on the north shore of Nunivak Island in the Bering Sea 30 miles offshore of the west coast of Alaska. Mekoryuk is well off the state’s road system, accessible only by air and sea. The purpose of the project was to provide new bulk fuel storage facilities to Alaska Village Electrical Cooperative (AVEC), Lower Kuskokwim School District (LKSD), City of Mekoryuk (City) and NIMA Corporation (the local ANCSA Native village corporation, and which is also the local fuels retailer), to replace the existing outdated and high-maintenance tank farms. The new tank farms consist of the following tanks and capacities:

PARTICIPANT	Number of Tanks	Gallon Size of Tanks	Total Fuel Oil	Total Gasoline	Total Gross Storage
AVEC	4	27,000	<b>108,000</b>	-	<b>108,000</b>
NIMA Corp.	7	27,000 (6) 10,000 (1)	<b>86,000</b>	<b>86,000</b>	<b>172,000</b>
CITY	2	27,000 (1) 10,000 (1)	<b>32,000</b>	<b>5,000</b>	<b>37,000</b>
LKSD	3	27,000 (2) 2,500 (1)	<b>56,500</b>	—	<b>56,500</b>
<b>GRAND TOTALS</b>	<b>16</b>		<b>282,500</b>	<b>91,000</b>	<b>373,500</b>

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These four participants purchase, store and supply most or all of the liquid fuels consumed by the residents of Mekoryuk. The IRA Council of Mekoryuk is also a participant, but does not directly control any storage capacity or other facilities. The facilities also include a new marine header and approximately 700 feet of new fill pipeline.

AVEC was the grantee and acted as overall project manager. Construction was managed by STG, Inc., (“construction manager” or “CM”) which also provided much of the heavy construction equipment and some of the skilled labor employed on the job; local skilled and unskilled labor was also employed. Conceptual design and construction design and engineering was accomplished by Coffman Engineers. Much of the base aggregate used on this project was dredged from the Mekoryuk small boat harbor using funds provided by the Denali Commission Transportation Program under award 344-02.

**Funding, Costs and Cost Containment:** Funding to date has been provided by Denali Commission and USDHHS – ANA grants to AVEC, and matching cash contributions from AVEC, shown as follows:

<b>Funding and Costs: Project 45A Mekoryuk Bulk Fuel Upgrade</b>	<b>Federal portion of award</b>	<b>AVEC match portion</b>	<b>Total All Sources</b>
DC award 0049-DC-2002-I2	\$ 148,573		\$ 148,573
DC award 0098-DC-2003-I12	\$ 147,383		\$ 147,383
DC award 170-05	\$ 3,362,594	\$ 106,016	\$ 3,468,610
ANA award 90NK0129	\$ 171,581	\$ 42,895	\$ 214,476
DC award 1182	\$ 1,601,828	\$ 48,938	\$ 1,650,766
<b>Total Funding (Budget)</b>	<b>\$ 5,431,959</b>	<b>\$ 197,849</b>	<b>\$ 5,629,808</b>
DC award 0049-DC-2002-I2	\$ 148,573		\$ 148,573
DC award 0098-DC-2003-I12	\$ 147,383		\$ 147,383
DC award 170-05	\$ 3,362,594	\$ 106,016	\$ 3,468,610
ANA award 90NK0129	\$ 171,581	\$ 42,895	\$ 214,476
DC award 1182	\$ 1,601,828	\$ 48,938	\$ 1,650,766
Costs not funded (cost overrun)		\$ 37,572	\$ 37,572
<b>Total Actual Costs</b>	<b>\$ 5,431,959</b>	<b>\$ 235,421</b>	<b>\$ 5,667,380</b>
Costs in excess of funding			\$ 37,572

Total costs (\$5,667,380) exceed total funding (\$5,629,808) by \$37,572. Since no further federal or other funding is forthcoming, this shortfall is considered an additional AVEC match portion.

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Design Shell Capacity: 373,500 gallons  
Constructed Shell Capacity: 373,500 gallons

Constructed cost per gallon \$15.17 per gallon  
Denali Commission benchmark cost \$7.50 to \$8.50 per gallon

The constructed cost per gallon of storage capacity is \$6.67 (about 78%) greater than the upper limit of the Denali Commission cost containment benchmark range for a tank farm of this size in this location.

**Time Line and Summary of Project Status:**

In 2003, Bristol Environmental and Engineering Services (BEES) prepared a preliminary Concept Design Report (CDR). It proposed replacing the existing facilities with the following:

- The community tank farm and dispensing area for the NIMA Store, City, and the IRA Council, were to be located in the same approximate location as the pre-existing facilities.
- The new LKSD BFU would be adjacent to their existing storage facilities.
- The proposed new AVEC power plant and tank farm were to be relocated to property adjacent to LKSD facilities, to facilitate a design for recovered heat to be provided to the LKSD school building.

Due to infrastructure and design challenges related to the BEES concept design report, Coffman Engineering was engaged for additional design support in 2004.

In July 2006, Coffman submitted an updated CDR, reflecting an additional geotechnical report and relocating the new AVEC tank farm and “snow-drift configuration” power plant back to AVEC’s existing site, and consolidating the City and NIMA store bulk fuel storage and dispensing locations. The LKSD new bulk fuel storage remained adjacent to their existing storage facilities. The system that had been envisioned to recover heat from the AVEC power plant and supply it to the LKSD school was removed from the design, due to the physical distance between the school and the power plant.

Denali Commission provided design and construction funding in September of 2006, based on the design and scope reflected in the Coffman CDR. On this type of project, business plans are typically written to guide the after-construction, day-to-day operations of the “community” tank farm (that portion of the facilities other than AVEC’s and LKSD’s). The business plan was adopted by the three community tank farm participants in November 2006 and forwarded to the DC for approval in December 2006; the plan stipulates that the City owns the community tank farm, the IRA administers the business plan and other agreements, and NIMA operates the retail dispensing of gasoline and fuel oil.

Construction began in June of 2008, which coincided with the small boat landing dredging project. The dredging project supplied the BFU project with sand to construct the BFU pads and containment dike ballast material. Erosion control practices were implemented on the sloping sides of the BFU facility pads, by planting coconut matting and grass seed.

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By the end of the 2008 construction season, the old tanks had been swapped out with new tanks in the community tank farm, the operators had been trained, and both the City and the NIMA store were operating their new dispensing stations. The new LKSD bulk fuel facility was partially complete.

Dry fall season conditions and strong winds revealed an unforeseeable erosion concern related to the LKSD BFU pad. The dry environment and strong winds were eroding the civil material under the LKSD tanks and sleeper, undermining the stability of the set tanks. To address this erosion, the CM retained certain equipment in Mekoryuk over the winter of 2008-2009 to avoid an additional (duplicate) mobilization and demobilization costs.

The CM returned to Mekoryuk in June of 2009, to address the erosion problem and the outstanding project items. They applied a commercially-available soil-stabilizing emulsion to all three tank farm pads. At the LKSD tank farm site, the tanks and sleepers were removed and repairs to the pad continued. After applying the emulsion, it was found that it only worked well when applied to areas which were not subsequently traveled across; whereas under paths of travel, the emulsion-hardened ground would crack and quickly deteriorate, allowing wind scouring to resume.

At this juncture of the project, the construction team determined that a 4" gravel cap over all travelled areas and exposed tank farm and dispensing areas would be less expensive, and substantially so in the long term, than continuously maintaining these areas. Arrangements were made to barge approximately 1800 cubic yards of gravel (over 2400 tons) from Nome to Mekoryuk in August 2009. The construction team then covered the BFU pads with approximately a 4"- 6" of gravel cap. Substantial completion of the new bulk fuel facilities was reached in October 2009.

Prior to construction, the CDR identified a total of 42 bulk fuel storage tanks in Mekoryuk owned by five parties as follows: AVEC (10 tanks), NIMA (14), City (6), LKSD (9), and the Mekoryuk IRA Council (3). Of all these, only one City-owned tank was judged potentially suitable for continued service (the tank serving the community water treatment facility). During the project, all tanks were emptied of their usable contents. The post-project status of the 42 tanks is as follows: the 10 AVEC tanks were cut up and placed in the community's landfill; 6 of the NIMA tanks were moved to a staging area on the periphery of the community; and the remaining 26 tanks have been left in their pre-project locations.

Of the 26 tanks left in place: 2 NIMA are tanks left in the old NIMA tank farm adjacent to the new bulk fuel facilities; the 9 LKSD tanks remain in the old LKSD tank farm for which LKSD has accepted long term responsibility; 1 is the City tank still located at the water treatment facility (same use/status as pre-project), 1 is a rolling-stock City tank used to refill the water treatment facility tank (same use/status as pre-project), and 4 remain at the City building; and the 3 IRA Council tanks and the remaining 6 NIMA tanks are in their original locations near the small boat harbor.

**Problems Encountered/Lessons Learned:**

- 1. The fuel cost spike of 2008.** This project was funded based on cost estimates completed in 2007. The fuel price spike of 2008 impacted it in many ways. Besides the obvious higher cost of fueling the

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construction equipment, it also raised the cost of shipping construction materials and construction equipment to this remote jobsite, and raised many raw material costs, and created a buying panic, further exacerbating the above problems. There were no hedging strategies or contractual risk transference in place to mitigate these unforeseen events.

2. **Challenges of replacing an existing operational tank farm in the same location.** Typically, a project like this would be sequenced as follows: build a new bulk fuel facility in a brownfield or greenfield site, transfer any remaining fuel from the old facility over to it, then decommission the old facility. However, for this project, since the new tanks were designed to be located on the same site as the existing tanks, the process was much more involved. Choreographing the steps involved in replacing each tank in place slowed down the planned construction at the community and AVEC tank farms (the LKSD tank farm was built at a new site and thus didn't encounter this problem).
3. **Unanticipated wind erosion.** The fill material used for the tank pads was sand dredged up as part of a harbor expansion project. Area winds that year were abnormally high, contributing to problematic wind scouring (blowing away) of this recently-laid material, thus weakening the soil around the tanks foundations, and containment dikes. Wind scouring was particularly problematic at the new LKSD tank farm site. The wind erosion occurred at a most vulnerable time, before the planned soil stabilization method (coconut matting and seeding) could take hold. Two alternate approaches were implemented:
  - **Applying chemical soil hardener.** The first remedial approach was to apply a binding emulsion. The emulsion is supposed to chemically bond the soil, and has been used extensively around airports in dusty environments, and by the U. S. military in Iraq and Afghanistan. The problem with this approach was that the soil would fracture if it were exposed to any pressure afterwards, such as from walking or driving across it. Once the surface was cracked, the underlying soil would continue to be blown away. This method was tried first because if it had worked, it would have been very cost-effective.
  - **Importing gravel cap.** The initial design called for putting gravel only along high traffic areas. After the failure of the emulsion to adequately prevent erosion, the construction team elected to top practically the entire area of the multiple tank farm sites with gravel, including accessible areas underneath tanks. Unfortunately, there is no suitable gravel source near Mekoryuk, so the required material – about 1800 cubic yards (over 2,400 tons) of gravel – had to be barged from Nome, almost 300 ocean miles away.
4. **Construction spreading into two seasons.** The intricacies of simultaneously decommissioning old tanks and installing new tanks on the same site for the community and AVEC facilities meant that the project could not meet the originally planned single-season installation schedule. Then, time was lost due to the unsuccessful soil emulsion application, and then the project had to import and place the gravel topping. Resolving the soil stabilization issues stretched construction into a second season, resulting in many charges, including longer rental period for the civil construction equipment.

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- 5. Barge shortage and limitations.** In 2008, demand exceeded supply of barges servicing western Alaska, driving up the costs, and delaying material deliveries. Also, winter arrived early that year, shortening the anticipated barge season. The backlog of undelivered 2008 materials resulted in barge capacity constraints into the 2009 season as well. Also, the water depth is shallow at the Mekoryuk harbor barge landing site, limiting service to smaller shallow-draft barges, which have less carrying capacity and require more trips. This resulted in higher costs to get all of the equipment and material in, and at the end of the project, to demobilize the equipment out.

In relation to the project budget cost overruns, the construction team and design engineer did take the initiative to provide value engineering and construction cost saving practices to reduce cost and schedule delays throughout the course of the project. The Design Clarification Verification Request (DCVR) system was utilized to expedite directive clarification and to provide direction for the construction management team and the design engineer. The process provided clear and precise direction in a timely manner for the construction team to benefit by having the ability to react timely; consequently reducing cost and limited burdening the project schedule.

**Outcomes and Conclusions:** The Mekoryuk Bulk Fuel Upgrade project is complete and provides code-compliant bulk fuel storage for essentially all of the fuel used by the community. The new facilities replace 317,787 gallons of substandard fuel storage.

**Bibliography:**

Bristol Environmental & Engineering. *Amalgamated Conceptual Design Report. Construction of a Bulk Fuel Storage Facility, Power Plant, and Wind Generator. Mekoryuk, Alaska.* Prepared for Alaska Village Electric Cooperative July 2003.

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